Transesterification reaction for synthesis of palm-based ethylhexyl ester and formulation as base oil for synthetic drilling fluid

ABSTRACT

The use of vegetable oil-based ester as a base fluid in synthetic drilling fluid has become a trend in drilling operations due to its environmental advantages. The transesterification reaction of palm oil methyl ester (POME) with 2-ethylhexanol (2EH) produced 98% of palm oil-based ethylhexyl ester in less than 30 minutes. Since the transesterification reaction of POME with 2EH is a reversible reaction, its kinetics was studied in the presence of excess EH and under vacuum. The POME-to-EH molar ratio and vacuum pressure were held constant at 1:2 and 1.5 mbar respectively and the effects of temperature (70 to 110°C) were investigated. Using excess of EH and continual withdrawal of methanol via vacuum promoted the reaction to complete in less than 10 minutes. The rate constant of the reaction (k) obtained from the kinetics study was in the range of 0.44 to 0.66 sï 1 and the activation energy was 15.6 kJ.molï 1. The preliminary investigations on the lubrication properties of drilling mud formulated with palm oil-based 2EH ester indicated that the base oil has a great potential to substitute the synthetic ester-based oil for drilling fluid. Its high kinematic viscosity provides better lubrication to the drilling fluid compared to other ester-based oils. The pour point (ï 15°C) and flash point (204°C) values are superior for the drilling fluid formulation. The plastic viscosity, HPHT filtrate loss and emulsion stability of the drilling fluid had given acceptable values, while gel strength and yield point could be improved by blending it with proper additives.

Keyword: Kinetic study; Transesterification; Drilling fluid; Ethylhexyl ester properties